DOD AND COMMERCIAL SOURCE INSPECTION/ACCEPTANCE PRACTICES

Final Report — Industry Benchmark Findings

March 31, 1998

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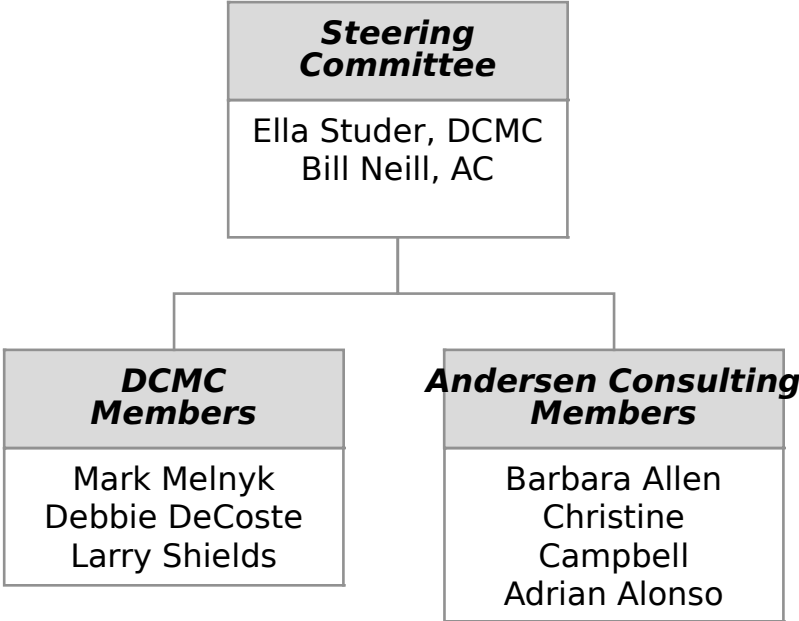- **Executive Summary**

- Company Selection for Benchmark

- Quality Assurance Framework

- Benchmark Company Observations

- Industry Quality Assurance Cost Estimates

- Industry Selection of Quality Assurance Methods

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The project team had as its objective to develop a comparison of DCMC quality assurance practices to those of world class companies. We used a comprehensive approach to achieve the objective.
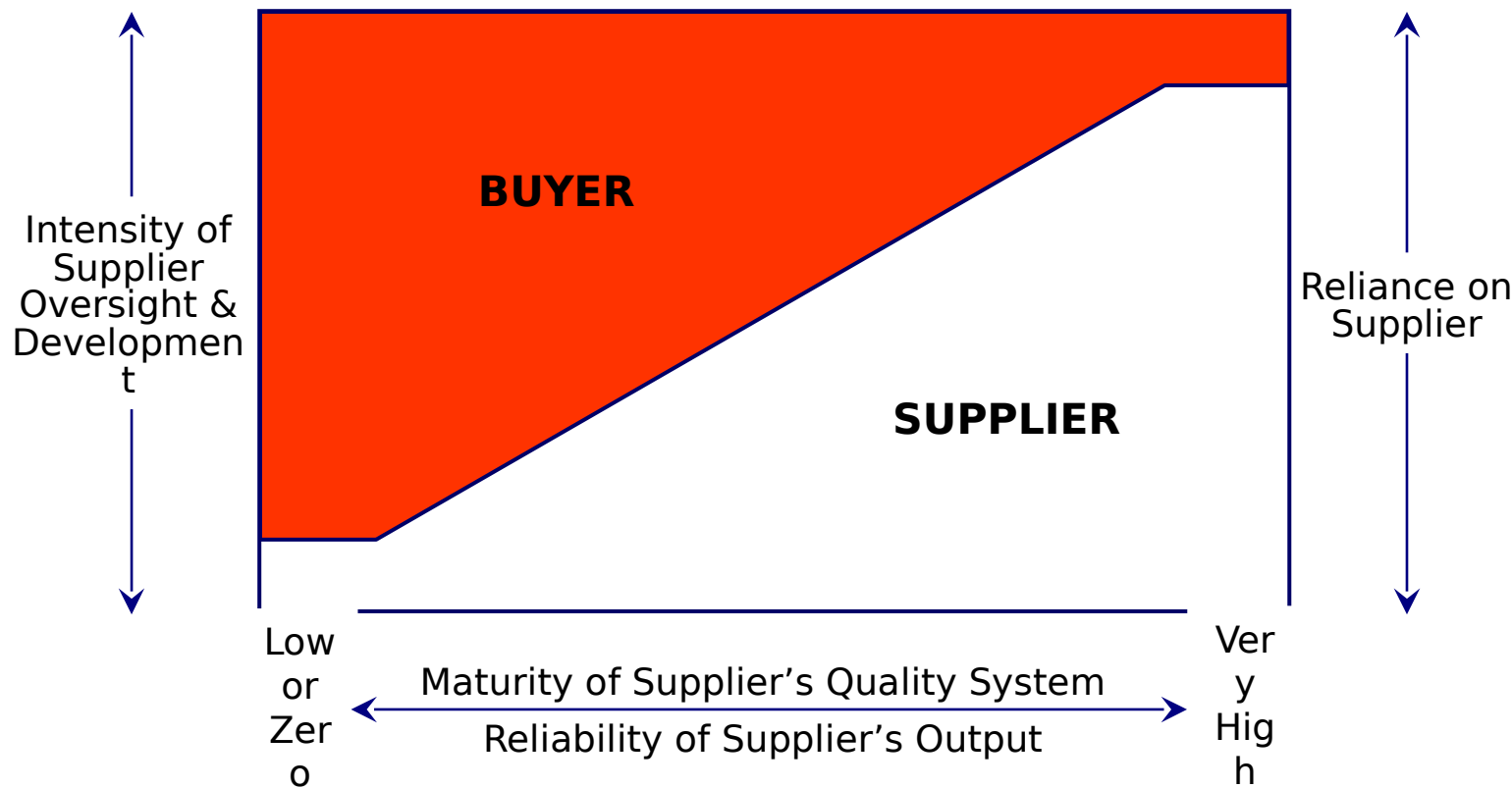
— *Cross-Organization Team* —

Steering Committee
Ella Studer, DCMC Bill Neill, AC

DCMC Members	*Andersen Consulting Members*
Mark Melnyk Debbie DeCoste Larry Shields	Barbara Allen Christine Campbell Adrian Alonso

— *Cross Section of Sites Visited* —

DCMC	Industry
■ Philadelphia ■ Hughes ■ Boeing C-17 ■ South Bend ■ Chicago	■ Boeing ■ Pratt & Whitney ■ Alaska Airlines ■ Northwest Airlines ■ Federal Aviation Agency ■ Hartwell Commercial ■ Toyota ■ Ryder Transportation Services ■ BNSF Railroad ■ Texas Instruments ■ Intel Corporation ■ Raytheon-TI Systems

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During the second half of the project we focused on conducting industry site visits to gather the information necessary to understand world class supplier quality assurance methods.
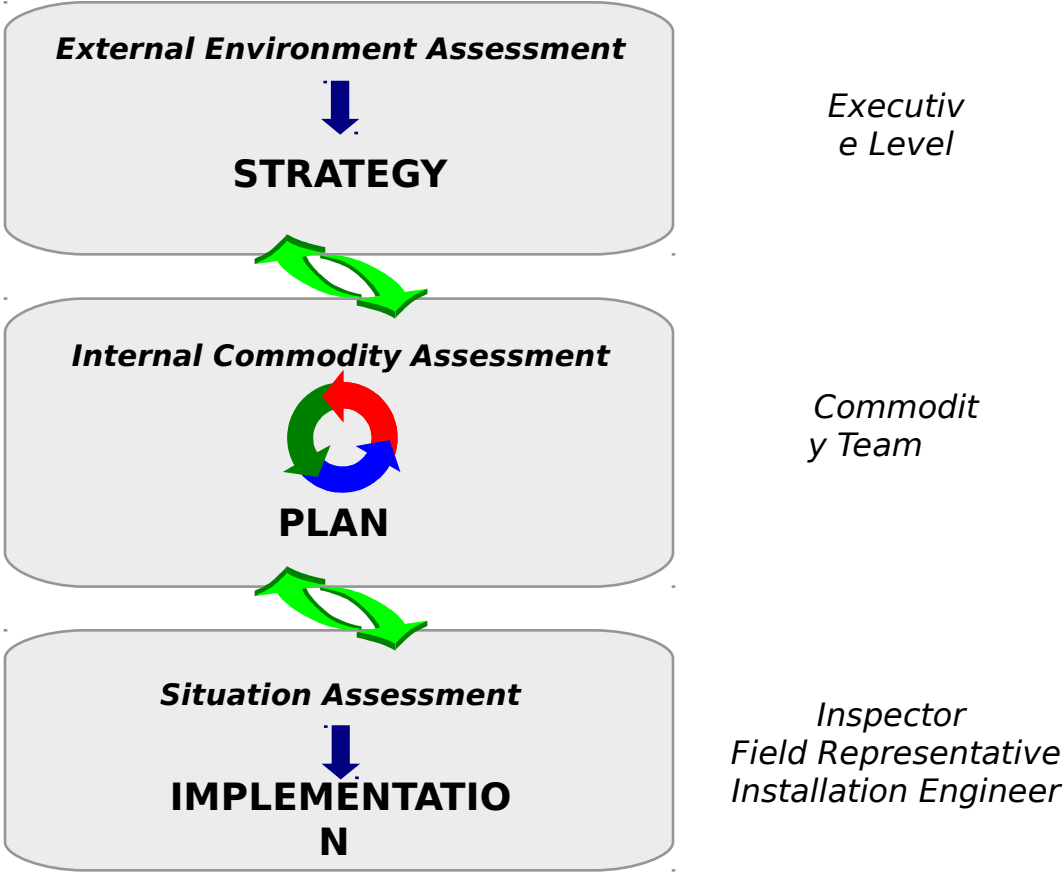
*— Areas of Focus for Industry
Visits —*

- Supplier Quality Management Overview

- Overview of Quality Assurance Methods
  - Range of methods used
  - Rationale for method selection

- Detailed Description of Quality Assurance Methods
  - Process overview and results
  - Resource requirements & skills
  - Scope of responsibilities

- Availability and Use of Quality Assurance Data

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All the world class companies we visited have either achieved or are moving toward reliance on the supplier to provide reliable quality materials.

Intensity of Supplier Oversight & Development

Reliance on Supplier

BUYER

SUPPLIER

Low or Zero

Very High

Maturity of Supplier's Quality System

Reliability of Supplier's Output

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Each company has a Quality Assurance Strategy to guide development of detailed quality plans for strategic commodities. The Quality Assurance Plans typically leverage multiple methods, often applying several methods concurrently.

External Environment Assessment	*Executive Level*
STRATEGY	
Internal Commodity Assessment	*Commodity Team*
PLAN	
Situation Assessment	*Inspector Field Representative Installation Engineer*
IMPLEMENTATION	

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Our research suggests achieving reliably high quality levels from your suppliers requires a clear path from Quality Assurance Strategy to detailed implementation.

Practice	*Basic*	*Progressive*	*World Class*
Develop an integrated Quality Assurance **Strategy**	• No formal Strategy ★		• Set at executive level • Quality used as a tool to achieve competitive advantage • Coordinated with procurement strategy ★★★★★★
Quality Assurance **Plan** developed to support Strategy	• Inspect product quality • Trade-offs between QA methods are not recognized • Not linked to an overall strategy ★	★	• Based on QA Strategy, commodity assessment, and business impact of failure • Commodity and risk specific • Trade-offs between QA Methods leveraged ★★★★★
Effective **Implementation** of quality assurance strategies	• QA Methods applied discretely • Intensity of application based on individual discretion ★	★★★	• QA Methods used in concert, often concurrently ★★★★

★ Benchmark Company Performance

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Successful implementation of the supplier Quality Assurance Strategy requires an organization structure with clearly defined roles, and range of responsibilities aligned with skill levels

Practice	Basic	Progressive	World Class
Training is key to personnel development _{See Note Below}	• Availability based on budget	• Availability based on needs ★★	• Continuous training is mandatory ★★★
Organization Structure with roles and responsibilities aligned with the QA Strategy	• Quality Assurance Plan often developed by the individuals responsible for implementation • Technical experts are responsible for performing audits and inspections, in addition to developing the Quality Assurance Plan ★	★	• Quality Assurance Strategy set at executive level • Commodity management teams own the Quality Assurance Plan • Detailed guidance provided to personnel responsible for implementation • Highly skilled technical experts implement Quality Assurance Plan ★★★★★★

★ Benchmark Company Performance

Note: Limited data availability - training only observed at five of the benchmarked companies

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Benchmark results showed technology is critical for effective implementation of the Quality Assurance Strategy, but specific application varies widely.

Practice	Basic	Progressive	World Class
Technology aligned with QA Strategy to enable efficient application of methods and to provide data for decisions See Note Below	• Isolated data storage • Limited or no data consolidation • Paper-based	• Manually intensive effort to transform data into useable information and reports • Suppliers given data via periodic reports ★★★★	• Global visibility of Quality Assurance data • Field failure tracking and reporting • Real-time adjustment of QA Method intensity based on performance data • Suppliers given real-time access to failure data • Automated transformation of data into usable reports ★★★★

★   Benchmark Company Performance

Note: No companies have all the technology elements listed for world class. We classified a company as world class if they had implemented two or more elements

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A comparison of DCMC practices to world class practices suggests there is a significant opportunity to improve effectiveness while maintaining or improving quality.

Practice	*Basic*	*Progressive*	*World Class*
Develop an integrated Quality Assurance **Strategy**	• No formal assessment of external environment • Ownership issues (larger than DCMC) • No formal response to assessment	• Starting to gain executive attention, indicated by acquisition reform initiatives • DoD buying organizations use source inspection to reduce their risks and costs, with minimal consideration of the impact on DCMC/total DoD budget	• Early CAS is the first step toward coordination with procurement
Quality Assurance **Plan** developed to support Strategy	• No strategy to link to • Predominantly limited to source inspection • Trade-offs between QA Methods not widely understood • Wide variation in surveillance plans from site to site	• One Book provides a centralized framework • Decentralized planning (definition of process detail) • Rolling out PROCAS as select sites • Performance-Based Assessment Model available to support staffing decisions	
Effective **Implementation** of quality assurance strategies	• Intensity of application based on individual discretion • QA Methods applied discretely • Wide variation in implementation from site to site	• Initiatives under way to limit DoD buyer's ability to direct which quality assurance method is used (PAT on requirements for GSI)	

Observed DCMC Performance

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A comparison of DCMC practices to industry practices in the application of training, organization and technology to support the supplier Quality Assurance Strategy also indicates areas of opportunity.

Practice	Basic	Progressive	World Class
Training is key to personnel development	• Some cuts due to budget	• Availability based on needs • Extensive technical training available	
Organization Structure with roles and responsibilities aligned with the Quality Assurance Strategy	• Quality Assurance Representatives (QAR) are responsible for developing surveillance plans • No commodity focus • Itinerant QARs are often responsible for multiple commodities	• QARs have the technical expertise to perform audits and inspections • Integrated Product Team concept - especially when the DoD buyer is included/involved	
Technology to enable efficient application of methods and to provide data for decisions	• Isolated storage of QA data • Limited data consolidation • Minimal visibility of field failures • Internet access not available at some sites	• World-wide electronic availability of One Book • Centralized PLAS data • Working to develop activity-based costing system • Internet used to communicate relevant information to the field	

▲ Observed DCMC Performance

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In summary, the benchmark comparison with World Class quality assurance practices shows DoD should focus on several critical areas.

— Conclusions —

Operating Strategy
■ Quality assurance efforts not integrated with procurement strategies
■ Not currently enabled to apply quality assurance methods focused on preventing defects
■ Current planning and implementation process does not clearly communicate when, how, and why each QA Method should be applied
■ Cost accounting for quality assurance

Organization
■ Current scope of responsibilities for QARs is broad
■ A different skill mix is needed to develop the Quality Assurance Plan
■ Ongoing training is essential
■ Greater commodity emphasis for planning

Technology
■ Current information systems do not provide prompt feedback of supplier Quality Assurance performance
■ Quality Assurance data is not available to support buyer or commodity-level decisions
■ Usage of current technology varies greatly

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- Executive Summary

- **Company Selection for Benchmark**

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— *Commercial Aerospace Industry Benchmark Participants* —

Industry	Company	User/ Manufacturer	Benchmark Illustration	Visit Focus
Aerospace	**Boeing Commercial Airplane Group** • Leading commercial aircraft manufacturer	Manufacturer	• Supplier qualification standards • Suppressed receiving inspection • Source inspection • Reliance on FAA certificate	Direct Material Complex Aircraft Component & Major Assemblies
Aerospace	**Pratt & Whitney** • Leading aircraft engine manufacturer	Manufacturer	• Supplier feedback • Source inspection • Material qualification lab	Direct Material, Complex Engine Components
Aerospace	**Alaska Airlines** • Commercial carrier	User	• Continuous part performance • First flight source inspection • Reliance on FAA certificate	Aircraft & Customer-Provided-Equipment
Aerospace	**Northwest Airlines** • Commercial carrier	User	• Supplier qualification • C.A.S.E. • Reliance on FAA certificate	Aircraft Spares & Repair Services
Aerospace	**Federal Aviation Agency** • Manufacturing Inspection District Office	N/A	• Delegated source inspection	Production, Type, & Air Worthiness Certificates

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— *Structural Fastener Industry Benchmark Participants* —

Industry	Company	User/ Manufacturer	Visit Focus
Fastener	**Boeing Commercial Airplane Group** • Leading commercial aircraft manufacturer, prime user of fasteners	User	Critical Structural Fasteners
Fastener	**Pratt & Whitney** • Leading aircraft engine manufacturer, known for high quality	User	Aircraft Engine Fasteners
Fastener	**Hartwell Commercial** • Largest market share of aerospace fasteners	Manufacturer	Raw material
Fastener	**Defense Industrial Supply Center**	User	Aerospace Fasteners

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— *Automotive/Mechanical Industry Benchmark Participants* —

Industry	Company	User/ Manufacturer	Benchmark Illustration	Visit Focus
Automotive	**Toyota** • Best of automotive manufacturers in quality	Manufacturer	• Supplier selection process • Supplier development • Direct delivery from certified suppliers • Material qualification- prototypes	Direct Material Automotive Components
Automotive	**Ryder Transportation Services** • Premier transportation equipment provider	User	• Supplier selection • Part rationalization • Root cause analysis • Material qualification - field tests	Trucks (all classes) and Truck Spares
Mechanical	**BNSF Railroad** • Class I railroad with a proven safety history	User	• Warranty Claim Tracking System	Locomotives, Freight Cars, and Spares

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— Electronics Industry Benchmark Participants —

Industry	Company	User/ Manufacturer	Benchmark Illustration	Visit Focus
Electronics	**Texas Instruments** • World leader, implementing new quality process	User	• Supplier qualification • SEMATECH	Highly Technical Fabrication Equipment
		Manufacturer	• Formal report card • Direct delivery from certified suppliers	Direct Materials-Overview of all Commodities
Electronics	**Intel** • Excellent quality process for commodities identified as "strategic"	Manufacturer	• Supplier certification • Supplier recognition • Supplier feedback • Root cause analysis • Certificates of conformance	Direct Materials-Silicon
Electronics	**Raytheon - TI Systems** • Sophisticated and mature quality system in place • Winner of the Malcolm Baldrige National Quality Award in 1992	Manufacturer	• Supplier development • Part rationalization	Direct Materials-Complex Electronic Components

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There are many similarities between the acquisition environment of the companies we visited and the DoD environment.

— DoD Acquisition Environment —

— Industry Parallels —

High impact of failure

→

Boeing Commercial Airplane Group - Structural Fasteners
Pratt & Whitney - Engine Components
Alaska Airlines & Northwest Airlines
Intel - Silicon Wafers
Texas Instruments - Direct Material
Texas Instruments - Fabrication Equipment
Ryder Transportation Services - School Buses

Required use of small, disadvantaged, and minority owned businesses

→

Boeing Commercial Airplane Group
Raytheon - TI Systems
    Corporate policy to identify & develop
Ryder Transportation Services
Toyota Motor Company of North America
    Required by Automotive Industry

Limited ability to promise long-term contracts

→

Boeing Commercial Airplane Group
Texas Instruments Fabrication Equipment
    Highly variable business cycles

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The companies we visited face many of the same challenges faced by the DoD; to further ensure comparability we included product users in the benchmark study.

— DoD Acquisition Environment —   *— Industry Parallels —*

User versus manufacturer

Alaska Airlines
Northwest Airlines
Texas Instruments - Fabrication Equipment
Ryder Transportation Services
BNSF Railroad

Small product volumes

Boeing Commercial Airplane Group - Wing Assy's
Texas Instruments - Fabrication Equipment
Alaska Airlines

New technology

Texas Instruments - Fabrication Equipment
Intel - 300mm diameter Silicon Wafers

Complex manufacturing process

All companies visited to date

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According to the Center for Advanced Purchasing Studies (CAPS), minority-owned/small business/women-owned suppliers received at least a total of 26.0% of the total purchases in four key industries.

SUPPLIER	INDUSTRY				AVERAGE
	Automotive	**Computer & Telecom Equipment**	**Aerospace/ Defense Contracting**	**Semiconductor**	
Minority-owned	2.8%	3.2%	—	2.0%	2.7%
Small Businesses	22.2%	22.5%	38.3%	22.4%	26.4%
Women-owned	1.0%	3.8%	3.3%	2.0%	2.5%
Total	*26.0%*	*29.5%*	*41.6%*	*26.4%*	*31.6%*
Small Disadvantaged	—	—	6.3%	—	—
Small Disadvantaged Women	—	—	1.5%	—	—

Source: CAPS Purchasing Performance Benchmark Studies

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The Center for Advanced Purchasing Studies (CAPS) 1997 Benchmarking Study of the Semiconductor Industry produced 50 procurement benchmarks. Key benchmarks developed are summarized below.

— Semiconductor Industry —

- On-site quality audits conducted at supplier facilities were used in 88 % of the companies for direct materials

- Cross-functional teams managed 76 % of direct materials

- The supplier quality function is being integrated into procurement

- Innovative new programs/practices are continuously being implemented by procurement departments
  - Addition of electronic payment upon receipt
  - Expanding use of EDI and purchasing cards

- For direct materials 65 % of suppliers were certified to ISO-9000

- 81 % of direct materials were delivered on-time

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The Center for Advanced Purchasing Studies (CAPS) 1997 Benchmarking Study of the Automotive Industry produced 25 procurement benchmarks. Key benchmarks developed are summarized below.

— Automotive Industry —

- Of all OEM suppliers, 52 % were ISO/QS certified

- EDI was used to process 81 % of total company purchase dollars.

- Each purchasing professional received 29 hours of training per year

- Of all active suppliers, 25 % received 90 % of company purchases

- During the one-year reporting period for the study, the number of active suppliers decreased by 2 %

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The Center for Advanced Purchasing Studies (CAPS) 1996 Benchmarking Study of the U.S. Computer and Telecommunications Industry produced 54 procurement benchmarks. Key benchmarks developed are summarized below.
— U.S. Computer & Telecommunications Industry —

- Cross-functional sourcing teams were used for:
  - 90 % of direct materials
  - 80 % of indirect materials and services

- On average, 17 people in the purchasing organization are allocated full-time to the supplier quality improvement effort

- Formal supplier rating systems are used by 100% of the firms
  - 90 % formally communicate the results to suppliers
  - 80 % use price, quality, and lead time as key measurement variables

- EDI was used to process 18 % of total company purchase dollars (20 % of purchase transactions)

- A JIT system is used to manage 19 % of the supply base

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The Center for Advanced Purchasing Studies (CAPS) 1997 Benchmarking Study of the U.S. Aerospace/Defense Contracting Industry produced 54 procurement benchmarks. Key benchmarks developed are summarized below.
— U.S. Aerospace/Defense Contracting Industry —

- 3 % of all purchased lots were rejected, 81% of rejects were the suppliers responsibility
  - 65 % were rejected because of hardware
  - 32 % were rejected because of paperwork
  - 15 % were rejected at the source
  - 74 % were rejected at incoming quality assurance

- Electronic Commerce was used to process 17 % of company purchase transactions
  - EDI was used by 56 % of the segments
  - Internet was used by 35 %
  - Electronic Cataloging was used by 15 %
  - E-Mail was used by 48 %

- The internet was used for sourcing information for 67 % of the segments

- Large Business Suppliers received 53 % of total segment purchase dollars

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